

Industrial Lighting Solution

Excellent Performance for Total Cost Savings

SAMSUNG



Key Considerations

Efficacy



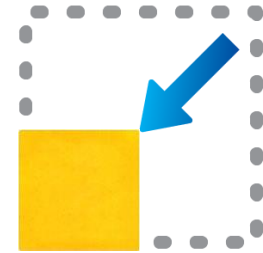
High efficacy LED enables overall system cost savings for industrial lighting

Reliability



Industrial environment requires higher level of reliability in terms of maintenance costs

Form Factor



Small form factor facilitates easier lens design and reducing fixture size

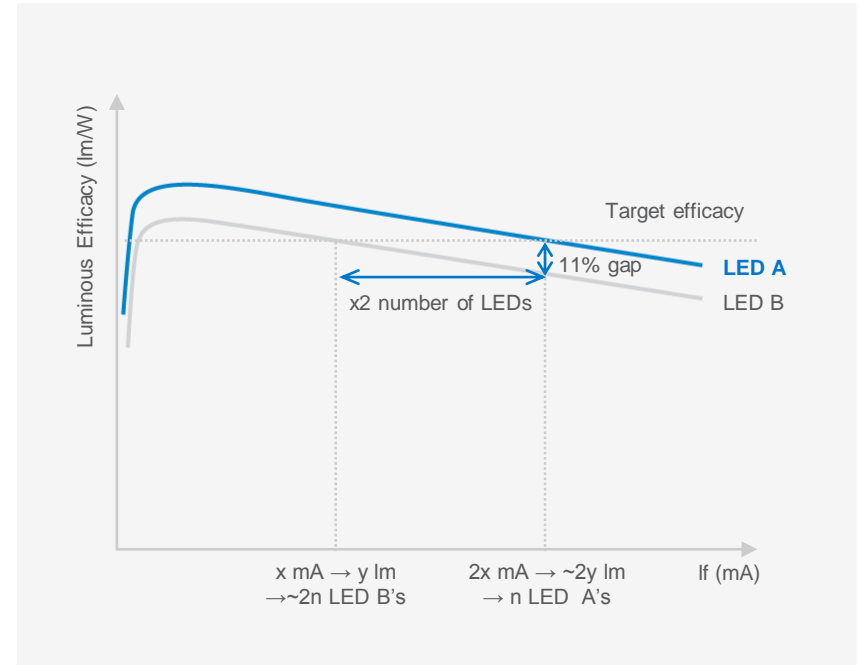
High Efficacy

Lighting system cost can be significantly reduced by high efficacy LEDs

- Target lumen: 47,000lm ↑
- Target efficacy: 196lm/W ↑ (@ PKG)

	PKG A*	PKG B**
Series x Parallel	17S x 28P	17S x 80P
IF/LED (mA)	180	65
Watt (W)	247	243
Luminous Flux (lm)	48,532	47,629
Efficacy (lm/w)	196	196
Number of LEDs	476 ea	1360 ea

75% ↓



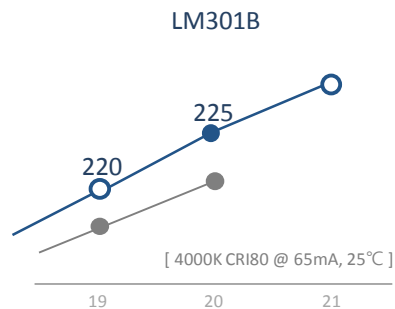
* PKG A: 39 lm, 218 lm/W @ 65 mA

** PKG B: 35 lm, 196 lm/W @ 65 mA

High Efficacy

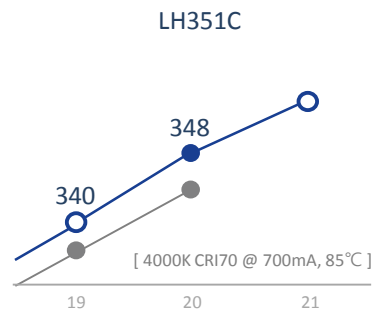
Samsung has the leading efficacy in lighting industry

MPL



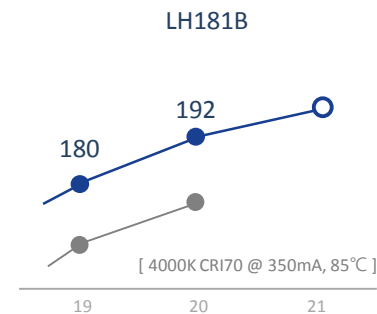
LM301B, LM301H

HPL



LH351B, LH351C, LH351D
LH351B-H, LH351C-H, LH351D-H

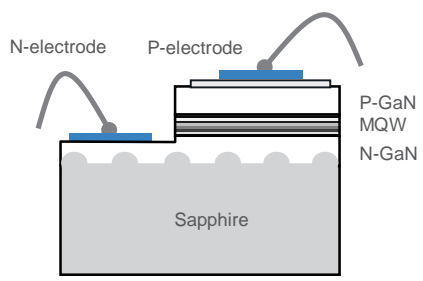
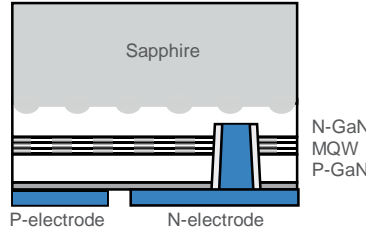
CSP



LM101B, LH151B
LH181B(+), LH231B(+)
LH171H, LH241H, LH281H

High Reliability

Flip-chip lowers failure rate (no wire) and thermal resistance

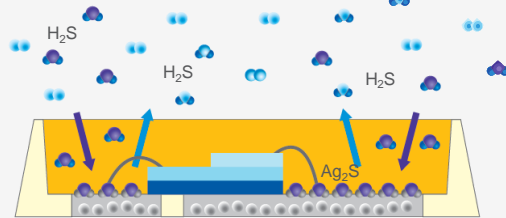
	Epi-up	Flip Chip
Structure	 <p>N-electrode P-electrode P-GaN MQW N-GaN Sapphire</p>	 <p>Sapphire N-GaN MQW P-GaN P-electrode N-electrode</p>
Photon Extraction	Lower	Higher
Vf	Higher	Lower
Rth	Higher	Lower
Current Spread on Die	Concentrate	Homogeneous

High Reliability

Samsung offers high anti-corrosion performance for industrial lighting

Conventional

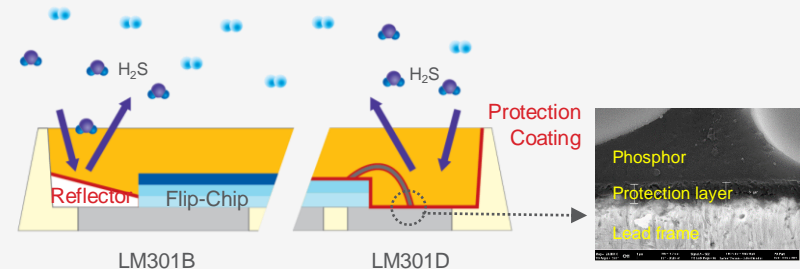
- Ag in wire or electrodes can be tarnished when exposed to H₂S
- $2\text{Ag} + \text{H}_2\text{S} + 1/2\text{O}_2 \rightarrow \text{Ag}_2\text{S} + \text{H}_2\text{O}$



Conventional LED

Samsung

- LM301B: Flip-chip with no wire
- LM301D: Protection coating to prevent Ag exposure



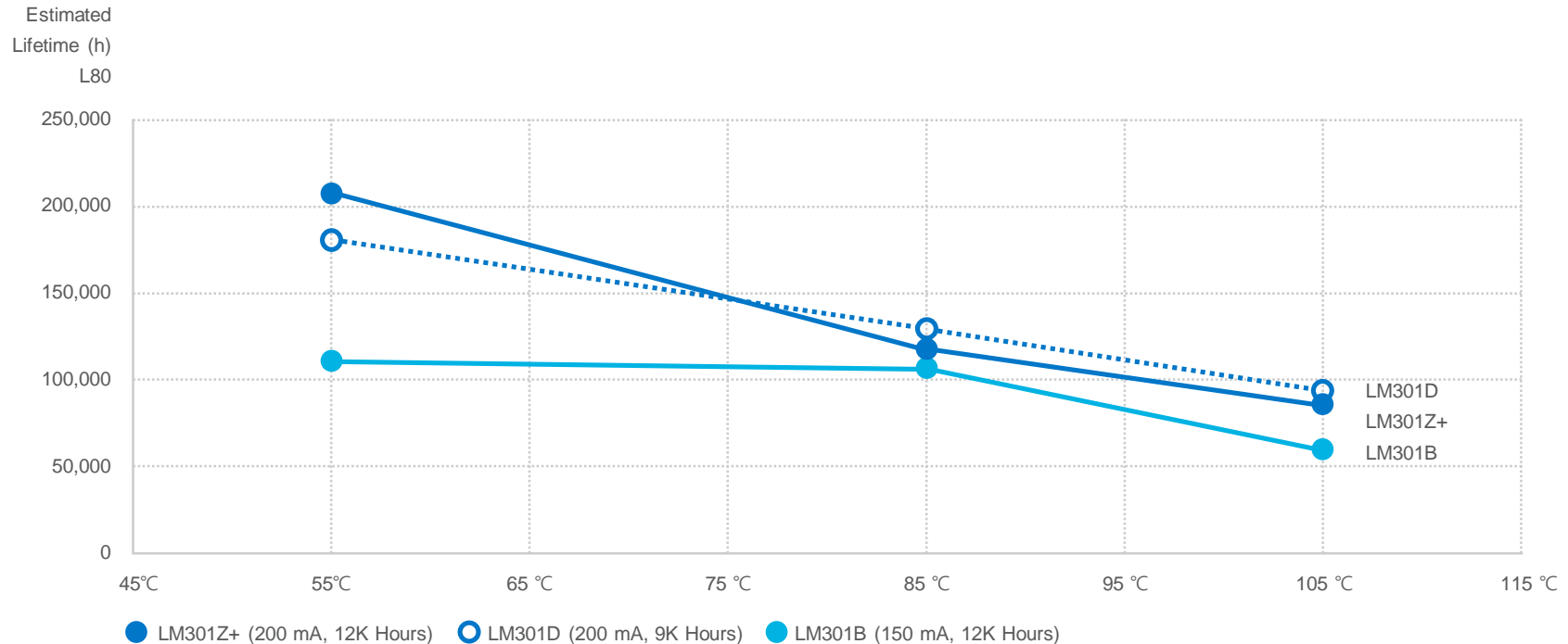
LM301B

LM301D

Product	LM301B (Flip-chip)	LM301Z+ (Epi-up)	LM301D (Epi-up)	LH502C (6V) (Epi-up)	LH351C (Flip-chip)
Lumen Maintenance (@IEC 68-2-43 Test)	99%	91%	91%	TBD (Apr.)	99%

High Reliability

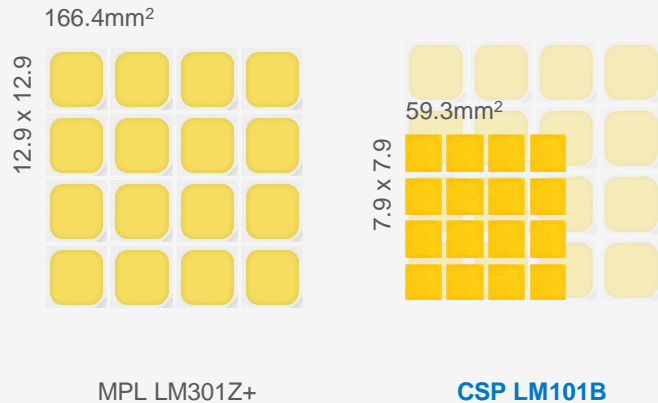
All Samsung LED packages accommodate DLC premium luminaires



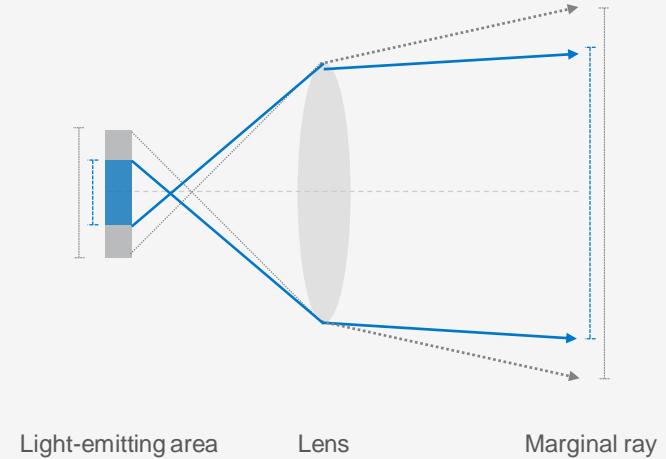
Small Form Factor

Small form factor expands design flexibility and reduces fixture cost

Enables Smaller Fixture Design



Easier 2nd Optic Design



Industrial Lighting Solution

Samsung delivers a full lineup with high efficacy and high reliability

	PCT	EMC			CSP		Ceramic		
	LM301B	LM301Z+	LM301D	LH502C	LH181B	LH231B	LH351B	LH351C	LH351D
Flux (lm)	39.0	36.0	36.8	700	180	350	181	350	490
Efficacy (lm/W)	220	196	208	179	186	175	192	176	170
Vf	2.72	2.82	2.72	6.1	2.75	2.85	2.7	2.85	2.75
Max Current (mA)	200	400	400	880	1,400	2,000	1,500	2,000	3,000
Form Factor (mm)	3.0×3.0	3.0×3.0	3.0×3.0	5.0×5.0	2.36×2.36	2.80×2.80	3.5×3.5	3.5×3.5	3.5×3.5
Chip	Flip-chip	Epi-up			Flip-chip		Flip-chip		
Condition	840, 65 mA, 25°C	840, 65mA, 25°C	840, 65 mA, 25°C	740, 640 mA, 25°C	740, 350 mA, 85°C	740, 700 mA, 85°C	740, 350 mA, 85°C	740, 700 mA, 85°C	740, 1,050 mA, 85°C

LM301B

Key Features

- Highest efficacy in LED industry
- Low thermal resistance ($7.5^{\circ}\text{C}/\text{W}$) enables slim heat sink
- Perfect anti-sulfurization



Specifications

	LM301B (65 mA)
Form Factor	3.0 X 3.0 mm
Max Current	200 mA
Vf	2.72 V
Luminous Flux	39.0 lm
Luminous Efficacy	220 lm/W

LM301Z+ & LM302Z+

Key Features

- Providing Single flux range & single Vf
- Standard footprint with $3.0 \times 3.0 \text{ mm}^2$
- EMC lead frame material with high reliability
- Anti-sulfurization



Specifications

	LM301Z+ (65 mA)	LM302Z+ (150 mA)
Form Factor	3.0 X 3.0 mm	
Max Current	400 mA	200 mA
Vf	2.82 V	6.32 V
Luminous Flux	36.0 lm	147 lm
Luminous Efficacy	196 lm/W	155 lm/W

LM301D & LM302D

Key Features

- Providing Single flux range & single Vf
- Standard footprint with $3.0 \times 3.0 \text{ mm}^2$
- EMC lead frame material with high reliability
- Anti-sulfurization



Specifications

	LM301D (65 mA)	LM302D (150 mA)
Form Factor	3.0 X 3.0 mm	
Max Current	400 mA	200 mA
Vf	2.72 V	6.25 V
Luminous Flux	36.8 lm	151 lm
Luminous Efficacy	208 lm/W	161 lm/W

LH502C & LH508C

Key Features

- Input high current → high luminous flux application
- Excellent lm/\$
- Input low current → high efficacy possible (215 lm/W @ 1W)



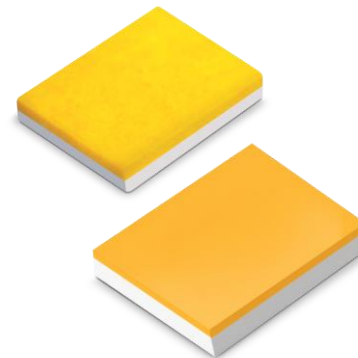
Specifications

	LH502C (640 mA)	LH508C (160 mA)
Form Factor	5.0 X 5.0 mm	
Max Current	880 mA	220 mA
Vf	6.1 V	24.4 V
Luminous Flux	700 lm	700 lm
Luminous Efficacy	179 lm/W	179 lm/W

LH181B & LH231B

Key Features

- Small form factor with high lumen output
- High anti-sulfurization performance
- Life time enhance products are also available



Specifications

	LH181B (350mA)	LH231B (700mA)
Form Factor	2.36 × 2.36 mm	2.80 × 2.80 mm
Max Current	1,400 mA	2,000 mA
Vf	2.75 V	2.85 V
Luminous Flux	180 lm	350 lm
Luminous Efficacy	186 lm/W	175 lm/W

Ceramic 3535 LEDs

Key Features

- Full lineup with same 3.5 × 3.5 mm form factor
- Industry leading performance (high efficacy)
- Highest reliability with long lifetime and high anti-sulfurization performance



Specifications

	LH351B (350 mA)	LH351C (700 mA)	LH351C (1,050 mA)
Form Factor	3.5 X 3.5 mm		
Max Current	1,500 mA	2,000 mA	3,000 mA
Vf	2.70 V	2.85 V	2.75 V
Luminous Flux	177 lm	350 lm	505 lm
Luminous Efficacy	188 lm/W	176 lm/W	169 lm/W
Substrate	Al ₂ O ₃	ALN	ALN

Thank you